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SPRAYING CALENDAR

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Spraying materials are of three kinds. One kind is used against insects that chew their food; another, against those that receive their nourishment through a sucking tube, or beak; and the third, against plant diseases. The first is called an internal, or stomach insecticide; the second, a contact insecticide, and the one that acts against plant diseases is known as a fungicide.

Stomach Insecticides

As the principal ingredient in the stomach insecticides mentioned is a form of arsenic, these poisons should not be used on lettuce, cabbage, or other vegetables or fruits when nearly ready for use.

Arsenate of lead.—Arsenate of lead is probably the best all-round stomach insecticide yet discovered. It is either a homemade or a commercial product. The homemade material is often not satisfactory; hence, the commercial product is to be preferred.

Of the ordinary prepared paste found on the market, use 3 pounds to 50 gallons of water; of the commercial powdered form, use 1½ pounds to 50 gallons of water.

Paris Green.—Paris green is another standard stomach insecticide.

Contact Insecticides

Soap solution.—An excellent contact spray for soft-bodied insects like plant lice is soap solution. It is made by boiling 1 pound of laundry or Ivory soap in from 12 to 15 gallons of water. When the soap is thoroly dissolved and cooled, it is ready to use. However, when the liquid is used while still warm, the action on the insects seems to be more rapid.

Tobacco extracts.—There are a number of products made from tobacco which are excellent insecticides against some of the soft-bodied insect pests like plant lice. These liquids contain from 20 to 45 per cent of nicotine sulfate. When put up by reliable firms, the percentage given may be depended on. The dilution necessary for spraying varies with the percentage of nicotine sulfate in the compound. If 40 per cent nicotine sulfate, use ½ pint in 50 gallons of water. These make excellent sprays for plant lice on leaves or stems of plants. Their insecticidal value is increased if a small quantity of dissolved soap at the rate of 1 pound to 15 gallons is added to the diluted spray.

Lime-Sulfur.—See under Fungicides.

Fungicides

Bordeaux Mixture.—Bordeaux mixture is a fungicide still used to a large extent in orcharding and potato-growing. The formula is: 5 lbs. copper sulfate (blue vitriol), 4 lbs. good stone lime, 50 gals. water.

Dissolve each in 25 gallons of water; then pour the two together into a 50-gallon barrel, stirring thoroly. This is the proper mixture for spraying apple trees. It is called the 4-4-50 formula. The first figure indicates the number of pounds of copper sulfate, the second, the number of pounds of lime, and the last, the number of gallons of water. (The Bordeaux formula is always expressed in this way; for example, 6-5-50 means, 6 pounds of copper sulfate, 5 pounds of lime, and 50 gallons of water.) It is usually considered unsafe to spray plum trees with more then three quarters of this amount of copper sulfate, or formula 3-4-50. The best way to dissolve the copper sulfate is in a cloth bag suspended in water, contained in a wooden barrel or cask. It should not come in contact with metal.

Copper Sulfate (Blue Vitriol).—For dormant trees a solution of 1 pound of blue vitriol in from 15 to 25 gallons of water makes an excellent fungicidal spray.

Lime-Sulfur.—Lime-sulfur is both an insecticide and a fungicide. It was first used as a sheep-dip, and then came into use as a scale insecticide. Many different formulas for its manufacture have been suggested, but there are two that stand out prominently—the self-boiled and the concentrated. The self-boiled is a homemade product, and is primarily a fungicide. It is used when trees are in foliage. The following is the formula: 8 lbs. good stone lime, 8 lbs. flowers of sulfur, 50 gals. water.

Put lime and sulfur together in a barrel and add cold water to slake the lime. Stir thoroly, adding enough water to prevent burning but not enough to "drown" the lime. When slaking has stopped, add enough water to make 50 gallons and strain through a fine mesh to work out all the lumps. All the lime should be worked through the strainer. The process usually requires from five to fifteen minutes. This mixture can be applied immediately to trees in foliage.

SPRAYING CALENDAR

Plant	Pest	Spray	First Spraying	Second Spraying	Third Spraying	Fourth Spraying	Remarks
Apple	Codling moth Curculio Scab Black rot Bitter rot	Arsenate of lead (3-50) plus concentrated lime-sulfur diluted (1 to 40), or Bordeaux mixture (4-4-50)	As center bud in flower cluster begins to show pink	Just after petals fall	2-3 weeks later	3-4 weeks later if codling moth, black rot, or bitter rot is present	Spraying just after the petals fall, getting as much of the liquid into the calyx cups as possible, is most effectual for codling moth. Destroy fallen leaves and all rotted fruit; prune out and burn all cankers; disinfect wounds. Trees should be thoroughly covered.
	Aphids or plant lice	Tobacco extract like Black Leaf No. 40	When insects appear				
	Scale insects	Lime sulfur (1-9)	Before buds burst in spring				
Cabbage Cauliflower	Cabbage worm	Arsenate of lead (3-50) or Paris green (1-50) Dust with the powdered form or with wood ashes	Whenever worms appear	Repeat when necessary			The poison will stick better to the leaf if used in soapy water. With cauliflower, great care must be taken if the plant is heading.
Cucumber	Cucumber beetle *Larvae or grubs*	Arsenate of lead or air-slaked lime or ashes Tobacco extract on roots	Dust as soon as insects appear	Repeat when necessary			The adult insects do not seriously injure cucumbers in cold frames, nor do larvae under field conditions.
Currant	Currant worm Leaf spot	Arsenate of lead or hellebore Bordeaux mixture	When insects appear Just as leaf buds are breaking	Repeat when necessary			When berries begin to turn, use hellebore to prevent discoloration.
Gooseberry	Currant worm Mildew	Arsenate of lead or hellebore Potassium sulfide (Liver of sulfur)	When insects appear Just as leaf buds are breaking	Repeat when necessary			Same as for currant. When mildew is abundant, spray every ten or twelve days.
Grape	Downy mildew Leaf hopper	Bordeaux mixture Some miscible oil or kerosene emulsion	Before blossoms come out As soon as possible after they make their appearance	When fruit has set	Two weeks later		The leaves should be kept well covered with Bordeaux mixture, especially during wet weather.
Plum	Brown rot Curculio	Arsenate of lead (3-50) plus concentrated lime-sulfur diluted (1 to 40), or Bordeaux mixture, (3-4-50)	Just before flower buds break	When plums are size of small peas	When fruit begins to color		Destroy all mummies (fruit shriveled by rot). Prune and burn affected branches in the fall. If whole tree is affected, cut down and burn.
	Plum pocket	Copper sulfate	Copper sulfate before any growth starts in spring	Bordeaux mixture as soon as growth starts			
	Scales	Bordeaux mixture Same as for apple.					
Potato	Blight (early and late) Beetle	Bordeaux mixture (5-5-50) Paris green (1-50) or arsenate of lead (3-50)	When plants are 8 inches high As soon as beetle eggs hatch	Repeat when necessary			Vines should be well covered with Bordeaux mixture throughout the season. This usually involves spraying every ten days or two weeks.
Raspberry and Blackberry	Anthracnose	Resin-Bordeaux mixture	Before leaves open				Cut out and burn diseased canes; keep old canes cut out. Protect with Bordeaux until canes are at least two-thirds grown.
Tomato	Tomato worms Leaf spot Black rot	Arsenate of lead (3-50) Bordeaux mixture	When worms appear Just after the fruit sets	Repeat when necessary			Vines should be well covered with Bordeaux throughout the season. Provide good ventilation.
Shrubbery	Red spider Powdery mildew	Water or some tobacco decoction Potassium sulfide (Liver of sulfur)	As soon as first seen Whenever mildew appears	Five or six days later	Ten days later		A flour paste made of 8 lbs. flour to 100 gals. water, added to the tobacco extract is very effective.
Sweet Pea	Plant lice Mildew	Soap solution or nicofume liquid Potassium sulfide	As soon as noticed As soon as it begins to appear	Repeat when	necessary		Spray should be very fine and put on forcibly. A spray of water alone is often very effective.

In almost every case, an insecticide can be combined with a fungicide, and it pays to make the combination when possible.
Never spray when trees are in bloom.
Other spraying formulae can be had by writing to the Division of Entomology or the Division of Plant Pathology, University Farm, St. Paul, Minn.

The concentrated lime-sulfur is both an insecticide and a fungicide At the rate of 1 gallon to 9 gallons of water, it is used **only** when the trees are dormant, at that time killing principally the scale insects At the rate of 1 gallon to 40 gallons of water, it is primarily a fungicide and is used with arsenate of lead when trees are in foliage The following is the formula, altho it is usually much better to buy the commercial product on account of its constant chemical properties 50 lbs fresh unslaked lime, 95 per cent pure, 100 lbs sulfur, thoroly and finely pulverized, water to make 50 gallons After proper mixing, this must boil from forty five to fifty minutes

Potassium sulfide (Liver of Sulfur) —Potassium sulfide is a fungicide employed when it is undesirable to discolor the foliage It is especially effective against mildew on gooseberry bushes and rust on carnations A fresh solution is yellowish-brown Formula 3 5 oz potassium sulfide, 10 gals water

Resin-Bordeaux Mixture —A resin mixture makes Bordeaux mixture or other spray compound stick better to a smooth surface, such as that of raspberry canes, when spraying for anthracnose The mixture is made as follows 5 lbs pulverized resin 1 lb concentrated lye 1 pt fish oil (or other animal oil), 5 gals water

Place the oil resin and 1 gallon of hot water in an iron kettle and heat until the resin softens Then add the lye and stir thoroly Add 4 gallons of hot water and boil until a little will mix with cold water, giving a clear, amber colored liquid If any water is lost in boiling add enough to bring the total back to 5 gallons and keep as stock

In using this in Bordeaux mixture dilute 2 gallons of this resin stock with water to make 10 gallons, and add to 40 gallons of Bordeaux mixture, made according to the formula given.

Combined Insecticide and Fungicide —Several insecticides can be combined with a fungicide, so that in one spraying insects as well as diseases may be killed The insecticides containing arsenic such as Paris green and arsenate of lead, are particularly adaptable to this combination, the amount of arsenical poison recommended being used in the fungicide at the rate given for its use with water The following combinations are recommended Arsenate of lead or Paris green with Bordeaux mixture

Arsenate of lead with lime-sulfur 1-40

Never use Paris green with lime sulfur

Nicotine sulfate, ¾ pint to 40 gallons, may be added to arsenate of lead Bordeaux mixture or arsenate of lead lime sulfur mixture The addition of the nicotine sulfate will control plant lice at the time of spraying

How to Spray

The method of applying the spray is often just as important as the nature of the material used Spray thoroly, giving special attention to the hardest places to reach See that every surface, the bottom of every crack, and the space behind the buds is wet with the spray. This can only be done by using high pressure and good nozzles For all orchard spraying run the pump at at least 150 pounds pressure, 200 pounds may be preferable Use a long spray rod with nozzles set at an angle of 45 degrees, so that by turning the rod the spray can be thrown from all directions onto every part of the tree or bush